

## Claims

- [c1] A barbed suture for connecting human or animal tissue in combination with a surgical needle, said combination comprising a barbed suture attached to a surgical needle, wherein the suture comprises a plurality of barbs projecting from an elongated body having a first end and a second end and a diameter, each barb facing in a direction and being adapted for resisting movement of the suture, when in tissue, in an opposite direction from the direction in which the barb faces, and wherein the surgical needle has a diameter with a ratio of the surgical needle diameter to the barbed suture diameter of about 3:1 or less
- [c2] The barbed suture and surgical needle combination according to claim 1, wherein the barbed suture and the surgical needle have an attachment selected from the group consisting of swaging, channel wrapping, heat shrinking, and eyelet threading.
- [c3] The barbed suture and surgical needle combination according to claim 1, wherein the surgical needle has a polymeric coating.
- [c4] The barbed suture and surgical needle combination according to claim 3, wherein the polymeric coating comprises a silicone material.
- [c5] The barbed suture and surgical needle combination according to claim 1, wherein the ratio of the surgical needle diameter to the barbed suture diameter is about 2:1 or less.
- [c6] The barbed suture and surgical needle combination according to claim 5, wherein the ratio of the surgical needle diameter to the barbed suture diameter is about 1:1 or less.
- [c7] The barbed suture and surgical needle combination according to claim 6, wherein the ratio of the surgical needle diameter to the barbed suture diameter is about 0.9:1 or less.
- [c8] The barbed suture and surgical needle combination according to claim 1, wherein the suture is made from a material selected from the group consisting of a bio-absorbable material, a non-absorbable material, and combinations

thereof.

- [c9] The barbed suture and surgical needle combination according to claim 8, wherein the bio-absorbable material is selected from the group consisting of polydioxanone, polylactide, polyglycolide, polycaprolactone, and combinations thereof.
- [c10] The barbed suture and surgical needle combination according to claim 8, wherein the non-absorbable material is selected from the group consisting of a polymer, a metal, a metal alloy, a natural fiber, and combinations thereof.
- [c11] The barbed suture and surgical needle combination according to claim 10, wherein the polymer is selected from the group consisting of polyamide, polyester, polypropylene, polyurethane, polytetrafluoroethylene, polyether-ester, and combinations thereof.
- [c12] The barbed suture and surgical needle combination according to claim 1, wherein the barbs have a disposition on the body selected from the group consisting of a staggered disposition, a twist cut multiple spiral disposition, an overlapping disposition, a random disposition, and combinations thereof.
- [c13] The barbed suture and surgical needle combination according to claim 12, wherein the barbs are in a staggered disposition, a twist cut multiple spiral disposition, an overlapping disposition, or a combination thereof, and the barbs are all facing in a direction toward only one of the first end and the second end.
- [c14] The barbed suture and surgical needle combination according to claim 12, wherein the barbs are in a staggered disposition, a twist cut multiple spiral disposition, an overlapping disposition, or a combination thereof, and the barbed suture has at least a first barbed portion and a second barbed portion, wherein the barbs of the first portion are facing in a direction toward only the first end and the barbs of the second portion are facing in a direction toward only the second end.
- [c15] The barbed suture and surgical needle combination according to claim 12, wherein the staggered disposition includes a first set of the barbs being radially

spaced about 180 degrees from a second set of the barbs.

- [c16] The barbed suture and surgical needle combination according to claim 12, wherein the staggered disposition includes a first set of the barbs being radially spaced about 120 degrees from a second set of the barbs and the second set of the barbs being radially spaced about 120 degrees from a third set of the barbs.
- [c17] The barbed suture and surgical needle combination according to claim 12, wherein the barbs are in a twist cut multiple spiral disposition and the barbed suture is made from a suture filament having a portion that is twisted from about 2 to about 17 times per inch when the barbs are escaped into the suture filament to make the barbed suture.
- [c18] The barbed suture and surgical needle combination according to claim 12, wherein the barbs are in a twist cut multiple spiral disposition and the suture has a spirality angle  $\alpha$  ranging from about 5 degrees to about 25 degrees.
- [c19] The barbed suture and surgical needle combination according to claim 18, wherein the spirality angle  $\alpha$  ranges from about 7 degrees to about 22 degrees.
- [c20] The barbed suture and surgical needle combination according to claim 19, wherein the spirality angle  $\alpha$  ranges from about 10 degrees to about 18 degrees.
- [c21] The barbed suture and surgical needle combination according to claim 12, wherein the barbs are in an overlapping disposition such that for at least two adjacent barbs, one being an overlapping barb and one being an overlapped barb, the overlapping barb has an underside and the overlapped barb has a topside where part of the underside of the overlapping barb is derived from part of the topside of the overlapped barb.
- [c22] The barbed suture and surgical needle combination according to claim 21, wherein each of the overlapping barb and the overlapped barb has a barb cut length, and the overlapping barb and the overlapped barb have a barb cut distance between them that is less than the barb cut length of the overlapped barb.

- [c23] The barbed suture and surgical needle combination according to claim 1, wherein the barbs have a configuration selected from the group consisting of (i) a barb cut angle  $\Theta$  ranging from about 140 degrees to about 175 degrees, (ii) a barb cut depth with a ratio of the barb cut depth to the suture diameter ranging from about 0.05 to about 0.6, (iii) a barb cut length with a ratio of the barb cut length to the suture diameter ranging from about 0.2 to about 2, (iv) a barb cut distance with a ratio of the barb cut distance to the suture diameter ranging from about 0.1 to about 6, (v) a corrugated barb underside, (vi) an arcuate barb base, (vii) at least two sets of barbs with each set having a barb size different from the barb size of the other set, and (viii) combinations thereof.
- [c24] The barbed suture and surgical needle combination according to claim 23, wherein the barb cut angle  $\Theta$  ranges from about 145 degrees to about 173 degrees.
- [c25] The barbed suture and surgical needle combination according to claim 24, wherein the barb cut angle  $\Theta$  ranges from about 150 degrees to about 170 degrees.
- [c26] The barbed suture and surgical needle combination according to claim 23, wherein the ratio of the barb cut depth to the suture diameter ranges from about 0.1 to about 0.55.
- [c27] The barbed suture and surgical needle combination according to claim 26, wherein the ratio of the barb cut depth to the suture diameter ranges from about 0.2 to about 0.5.
- [c28] The barbed suture and surgical needle combination according to claim 23, wherein the ratio of the barb cut length to the suture diameter ranges from about 0.4 to about 1.7.
- [c29] The barbed suture and surgical needle combination according to claim 28, wherein the ratio of the barb cut length to the suture diameter ranges from about 0.8 to about 1.5.
- [c30] The barbed suture and surgical needle combination according to claim 23,

wherein the ratio of the barb cut distance to the suture diameter ranges from about 0.5 to about 4.5.

- [c31] The barbed suture and surgical needle combination according to claim 30, wherein the ratio of the barb cut distance to the suture diameter ranges from about 1 to about 3.5.
- [c32] A barbed suture for connecting human or animal tissue in combination with a surgical needle, said combination comprising a barbed suture attached to a surgical needle, wherein the suture comprises a plurality of barbs projecting from an elongated body having a first end, a second end, and a diameter, each barb facing in a direction and being adapted for resisting movement of the suture, when in tissue, in an opposite direction from the direction in which the barb faces, wherein the barbed suture and the surgical needle have an attachment selected from the group consisting of swaging, channel wrapping, heat shrinking, and eyelet threading, and wherein the surgical needle has a diameter with a ratio of the surgical needle diameter to the barbed suture diameter of about 3:1 or less.
- [c33] A barbed suture for connecting human or animal tissue in combination with a surgical needle, said combination comprising a barbed suture attached to a surgical needle, wherein the suture comprises a plurality of barbs projecting from an elongated body having a first end, a second end, and a diameter, each barb facing in a direction and being adapted for resisting movement of the suture, when in tissue, in an opposite direction from the direction in which the barb faces, wherein the barbs are in a staggered disposition, and wherein the surgical needle has a diameter with a ratio of the surgical needle diameter to the barbed suture diameter of about 3:1 or less.
- [c34] A barbed suture for connecting human or animal tissue in combination with a surgical needle, said combination comprising a barbed suture attached to a surgical needle, wherein the suture comprises a plurality of barbs projecting from an elongated body having a first end, a second end, and a diameter, each barb facing in a direction and being adapted for resisting movement of the suture, when in tissue, in an opposite direction from the direction in which the

barb faces, wherein the barbs are in a twist cut multiple spiral disposition and the suture has a spirality angle  $\alpha$  ranging from about 5 degrees to about 25 degrees, and wherein the surgical needle has a diameter with a ratio of the surgical needle diameter to the barbed suture diameter of about 3:1 or less.

[c35] A barbed suture for connecting human or animal tissue in combination with a surgical needle, said combination comprising a barbed suture attached to a surgical needle, wherein the suture comprises a plurality of barbs projecting from an elongated body having a first end, a second end, and a diameter, each barb facing in a direction and being adapted for resisting movement of the suture, when in tissue, in an opposite direction from the direction in which the barb faces, wherein the barbs are in an overlapping disposition such that for at least two adjacent barbs, one being an overlapping barb and one being an overlapped barb, the overlapping barb has an underside and the overlapped barb has a topside where part of the underside of the overlapping barb is derived from part of the topside of the overlapped barb, and wherein the surgical needle has a diameter with a ratio of the surgical needle diameter to the barbed suture diameter of about 3:1 or less.

[c36] A barbed suture for connecting human or animal tissue in combination with a surgical needle, said combination comprising a barbed suture attached to a surgical needle, wherein the suture comprises a plurality of barbs projecting from an elongated body having a first end, a second end, and a diameter, each barb facing in a direction and being adapted for resisting movement of the suture, when in tissue, in an opposite direction from the direction in which the barb faces, wherein the barbs are in a staggered disposition, and wherein the surgical needle has a diameter with a ratio of the surgical needle diameter to the barbed suture diameter of about 3:1 or less.